

AIR QUALITY MONITOR AND ACID RAIN NETWORKS

By Hans Rudolph*

AIR QUALITY MONITOR PROGRAM

The air quality monitor program consists of two permanent air monitor stations (PAMS's) and four mobile Shuttle pollutant air monitor stations (SPAMS's). The PAMS measures SO_x, NO_x, particulates, CO, O₃, and nonmethane hydrocarbons. The SPAMS measures O₃, SO₂, HCl, and particulates.

Status of PAMS

The second PAMS unit (PAMS 2) is complete and is operating on local with the digital HP-1B system. It will be moved from Launch Complex 39 (LC-39) to Tico Airport (Gate 3) after approval for this site has been obtained. (Siting plans are mapped in fig. 1.) The second PAMS unit is operational in the analog mode and is awaiting memory cards for the digital system. Sample ozone data from PAMS 2 are shown in table I. Sample O₃ data are plotted in figure 2. High values exceeding Environmental Protection Agency (EPA) standards are frequently observed.

Status of SPAMS

Construction of mobile SPAMS units 3, 4, and 5 is still underway. All four units are complete except for O₃, SO₂ high-volume, and HCl analysis stations. A preliminary selection of sites has been made as follows.

<u>Unit</u>	<u>Site</u>
SPAMS 3	Arthur Dunn Airport, Gate 4
SPAMS 4	TPQ 18, Merritt Island, Gate 2
SPAMS 5	Port Canaveral, Gate 1
SPAMS 6	Florida Technological University (FTU) field laboratory, North Merritt Island, Gate 5

*NASA John F. Kennedy Space Center.

HCl Dosimeters

Hydrogen chloride dosimeters have been developed using Office of Applied Science and Technology funding. A total of 60 geometeorological units has been delivered. Laboratory tests show a sensitivity of 0.4 to 1 ppm-sec, specific for HCl. Use of the units to monitor the ground cloud from the November 1978 Titan launch is planned.

RAIN MONITOR PROGRAM

The NASA John F. Kennedy Space Center (KSC) had six rain collectors operating in July 1976. By November 1976, the number had increased to 7 and by February 1977 to 12 rain collectors. In March 1978, 18 rain collectors were operational. The current problem in the rain monitor program is the collection and analysis of data from all sites.

Data Analysis Software

The software for the rain monitor program includes the following.

1. Logging of rain data on disk files - There is a problem with trying to analyze the data base because the amount of memory required to load the data base and run the computer codes simultaneously is not currently available.
2. A statistics program that runs complete statistical analyses of the data, including mean, average, standard deviation, and confidence level
3. A plotting program to plot any rain parameter against any other parameters, such as the pH value
4. A data summary (due April 1978)
5. Meteorological data comparison - Data will be analyzed against mesoscale and local wind patterns.

Bucket Contamination Study

The bucket contamination study has been completed. Twelve buckets were used (four in the runways, four in the building, and four out in the back yard). These buckets were put out for 7 days. Then, 200 milliliters of water was put in the buckets, and the solution was tested for contamination. The concentrations of impurities did not change very much - they were very small, less than 5 or 10 percent. Basically, then, there was no significant change in a period of 7 days. One contamination problem occurred when the wind blew over an open collector and contaminated the contents. When a collector is not operating, it would be helpful to put an indicator on it to guarantee that the collector is not opened prematurely. It was generally

found that standard deviation of all the samples run on the five collectors 5 meters apart was less than 10 percent of the standard deviation between the elements (which is well within the tolerance expected). Handling quality and the washing seem to be within the 10-percent variation. Dr. Madsen has been using quality control procedures on personnel and on equipment in the hardware by running duplication replicas for every 10 samples.

Summarized data are given in table II for the month of December. The table shows the number of samples collected on selected days of the month.

There is a rainfall measurement system at Cape Canaveral called "tipping buckets." Approximately 18 to 30 of the buckets measure rainfall to hundredths of an inch and send the data back remotely. These buckets are available but are very expensive to operate.

This program is conducted for background regional surveys and is not directly related to the launch. The results of any launch will be seen by the same rain network. If launch results are not seen by that network, one might speculate as to whether there were any real results. However, the network might not provide much data about a Shuttle launch. The KSC has preliminary plans to collect a large number of rain samples over large areas for the first Shuttle launch, but these plans have not yet crystallized.

TABLE I.- SAMPLE OZONE DATA FROM PAMS 2

Sampling date	Time sampled		Range, ppb		Daily av, ppb		Daily time, hr		Wind direction, deg		Over EPA standard		
	d	hr	High	Low	High	Low	High	Low	High	Low	d	hr	percent
Sept. 1977	16	352	48 to 100	10 to 62	73.6 ± 16.5	34.6 ± 17.1	14.4 ± 5.8	8.1 ± 5.2	130 ± 112	--	3	12.9	4
Oct. 1977	26	572	33 to 134	5 to 84	68.8 ± 22.7	36.3 ± 19.1	13.2 ± 6.4	11.2 ± 7.8	119 ± 99	--	6	22.3	4
Nov. 1977	27.5	605	35 to 70	8 to 54	57.0 ± 8.5	24.8 ± 13.3	14.3 ± 4.8	7.4 ± 7.5	110 ± 86	--	0		
Dec. 1977	29.5	649	36 to 115	0 to 58	59.5 ± 14.8	21.8 ± 13.1	14.5 ± 5.6	9.4 ± 8.6	174 ± 121	256 ± 72.4	2	4.3	.66
Jan. 1978	29.5	649	98 to 51	11 to 57	69.2 ± 12.9	31.9 ± 12.7	17.6 ± 4.5	4.6 ± 4.9	159 ± 115	242 ± 94	6	32.3	4.9
Feb. 1978	27.5	605	123 to 58	22 to 58	88.3 ± 18.6	39.7 ± 16.6	16.4 ± 5.2	5.66 ± 5.1	181 ± 126	278 ± 66	16	131	21.7

TABLE II.- RESULTS FROM BEST KSC RAIN COLLECTION NETWORK^a

(a) Basic data

Collection day, Dec. 1977	No. of samples	Sample pH for collector no. -						
		1	11	12	13	14	18	19
1	4			4.27	4.33	4.24		5.01
2	2	4.41					4.68	
5	5			4.08	3.97	4.17	3.90	4.18
6	7	4.70	4.77	4.66	4.72	5.06	4.67	4.88
9	1						4.78	
12	6	4.93	4.91	4.61	4.87	4.44		4.72
13	5	4.53	4.69	4.65	4.53	4.66		
14	7	5.26	5.36	5.20	4.99	5.26	4.86	5.25
15	6	4.16	4.84	6.54	4.79	4.41		5.05
16	7	4.56	4.63	4.76	4.60	4.59	4.72	4.47
19	7	4.50	4.96	4.43	4.73	4.38	4.86	4.72
21	4	4.25		4.27	4.22	4.42		
22	7	4.08	4.10	4.17	4.18	4.25	4.03	4.00
28	6	4.66	4.52	4.59	4.62	4.57		4.58

(b) Statistical data

Parameter	Value for collector no. -						
	1	11	12	13	14	18	19
Monthly total vol, ml	3697	5983	5008	6464	5071	5025	8043
Vol weighted pH av	4.54	4.71	4.67	4.66	4.65	4.49	4.68
pH deviation . . .	0.34	0.34	0.69	0.31	0.33	0.38	0.39
pH range High	5.26	5.36	6.54	4.99	5.26	4.86	5.25
Low	4.08	4.10	4.08	3.97	4.17	3.90	4.00
Amt total H ⁺ . . .	107.3	116.08	107.69	142.28	114.21	161.74	168.47

^aTotal collectors, 7; total samples, 74; collections, 140; ratio of total samples to collections, 52.8 percent.

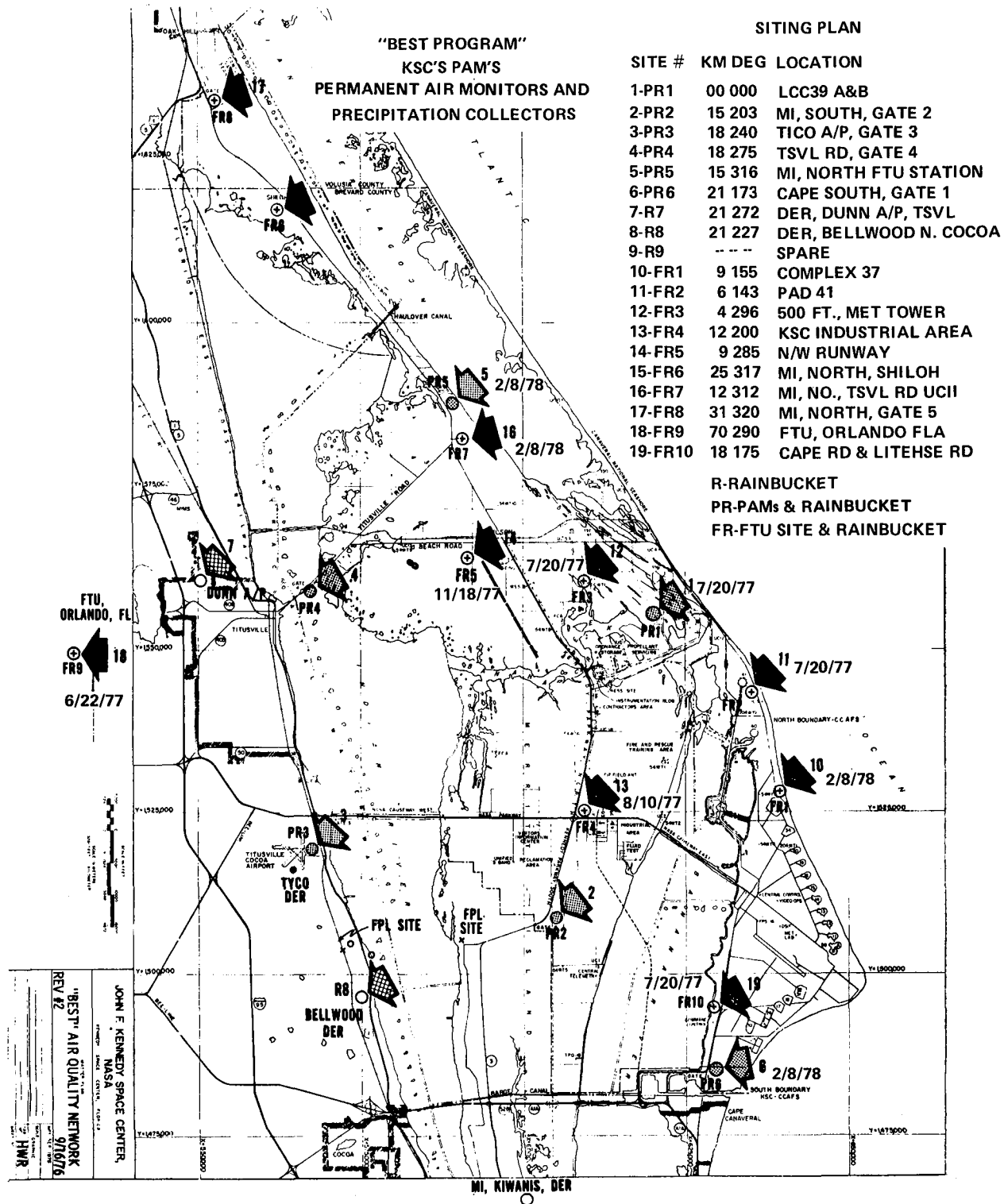


Figure 1.- Siting plan for KSC PAMS units.

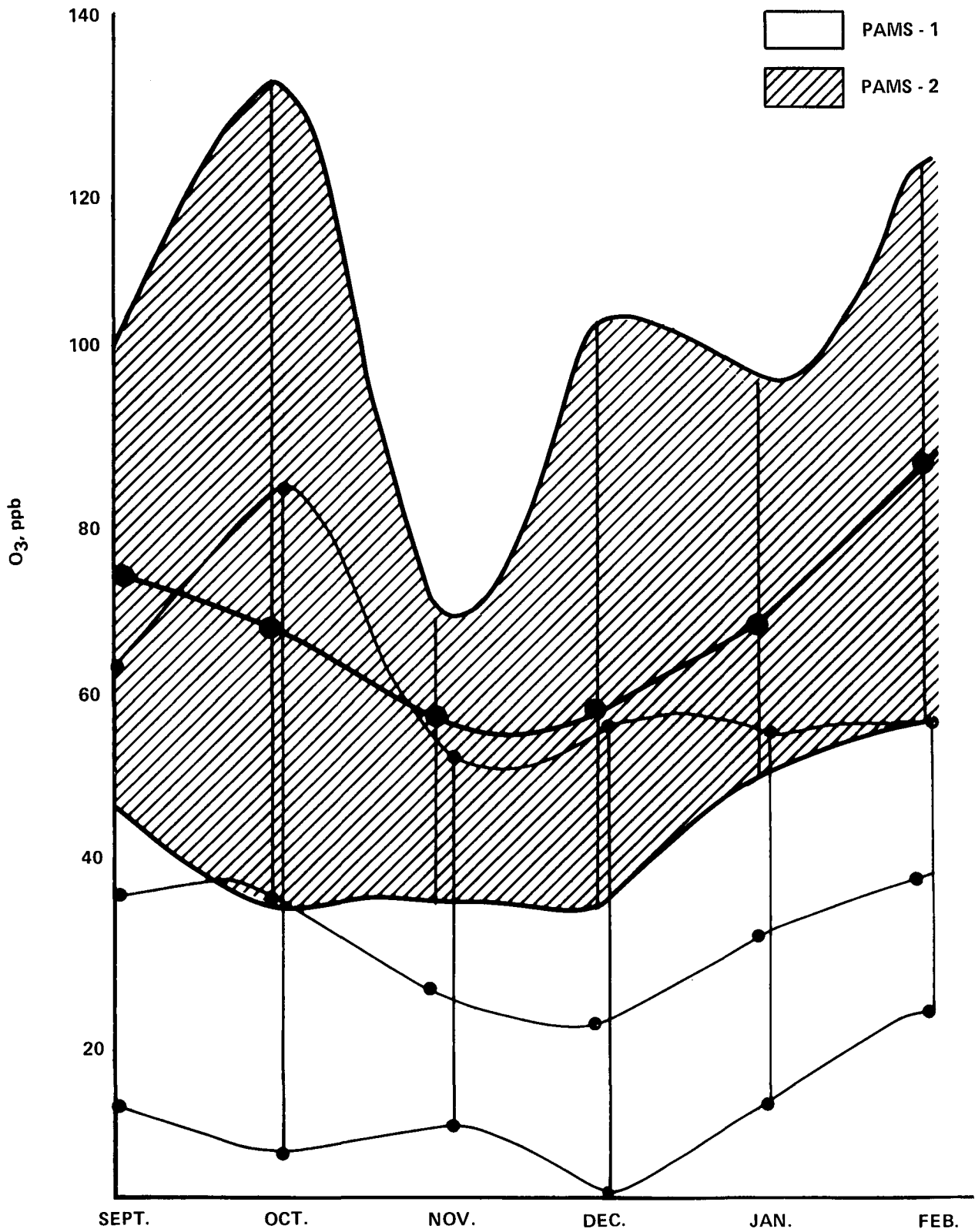


Figure 2.- Ozone concentration data for KSC, September 1977 to March 1978.